

# Voting Based Group Recommendation: How Users Vote

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## ABSTRACT

It has been shown that social information as group structure or personality characteristics improve the group recommendation. Sometimes no such information is available, specifically when ad-hoc groups are constructed. Moreover, often the items' content is not available (or users' preferences are unknown). In this paper we explore the usage of voting based group recommendation and the users preference for such a method settings – we analyze aggregation strategies preferences, sharing preferences and users re-rating consistency.

## Categories and Subject Descriptors

H.3.3 [Information Technology and Systems]: Information filtering

## General Terms

Experimentation, Human Factors

## Keywords

Group recommendations, voting, aggregation strategies

## 1. INTRODUCTION

Group recommendation gets more and more attention in today's adaptive web-based applications [1]. Users' social activity over the Web is increasing and thus new domains and applications as movie, learning or games are available. When recommending to the group of users the social structure and personal characteristics plays important role from the group satisfaction point of view [3]. On the contrary, sometimes there is not possible to obtain these characteristics. When the group is constructed ad hoc – from “random” users it is almost impossible to collect information about the group structure or users characteristics (usually obtained by various questionnaires) [2].

One of the best performing approaches for the group recommendation, which is suitable for active groups is the recommendation based on voting of group members. Group members suggest their preferred items and then the voting is performed by the group. It is clear that the voting process, especially when performed online and when the goal is to reach consensus, can be influenced and enhanced by various aspects (e.g., sharing preferences, aggregation strategies, group size, users' consistency). In order to investigate the influence of these specific aspects we propose a voting mechanism in the domain of movies.

## 2. VOTING BASED RECOMMENDATION

Proposed approach consist of the construction of user's ratings matrix, which is created based on users' votes (*Items x Votes*). Every user can vote for the items already voted by other users, or the new item can be added as the suggestion to the group. Next, the matrix of normalized ratings is constructed (Min-max normalization) in order to minimize low or high ratings influence to aggregation strategy. Finally, the total of three representative aggregation strategies (additive, multiplicative and additive with minimal satisfaction) are used in order to construct the group recommendation, which is presented to users:

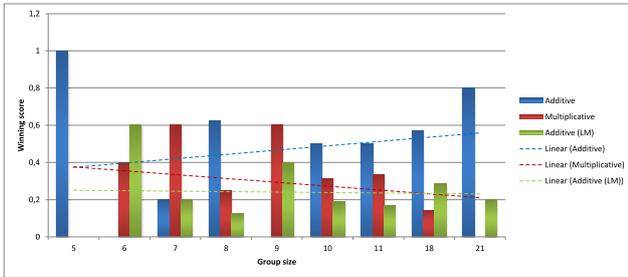
1. Create user's rating matrix and the normalized rating matrix respectively.
2. Aggregate votes from group members (users rating matrix).
3. Recommend items with highest votes.

Not only the lack of users' preferences knowledge or sufficient group activity indicate to use the voting based group recommendation. Often there is no information about the recommended content available (e.g., movie genre, director), which are used for the standard similarity search. In the voting based approach, this information is processed by the users, thus no content analysis or the lack of new items is required or present.

### 2.1 Evaluation and Results

Proposed approach was implemented as a simple web-based application MovieRec and available for the free usage within the social network Facebook during the experiment. We expected that – users' ratings are more consistent as when no sharing preferences are presented. We also believe that users' ratings are influenced by the group context – users' re-ratings (rating previously rated item in new event and group) are influenced by the group and event context. The total of 73 real users within 10 days voted for 902 movies (obtained from IMDB database), which were self-divided into the 11 groups and 93 voting events.

The task presented to the users was to create or to join some event and try to reach consensus (based on the voting) on which items should be watched together within the group. For every created event the users voted for their



**Figure 1: Ratio of winning voting strategies compared to the group size.**

candidates to watch. They could create new suggestions until the event deadline. During the experiment we were observing the users’ behavior based on the sharing preferences (in the half of events the preferences of other group members were visible), users’ consistency and the performance of used aggregation strategy. After the event deadline, three lists of the generated recommendations were presented to every user of the group (additive, multiplicative and the additive with minimal satisfaction consideration strategy). Every user rated for the best recommendation of these three presented lists.

**Results – aggregation strategies.** Our first question was which strategy is preferred based on the group size. When comparing the winning strategy depending on the group size we discovered that larger groups (more single-users’ preferences have to be aggregated) prefer additive strategy, while the decreasing trend can be observed when multiplicative strategy is used (Figure 1). Finally, the additive strategy with least misery performed the worst. This can be explained by the fact that least misery prefers votes from the minority, thus when only one user dislikes an item, this item will not be recommended. With the group size and users’ satisfaction, the number of such users is increasing, thus the quality of recommendation is decreasing. Similarly, when the multiplicative strategy is used, low ratings of few users can influence whole recommendation dramatically, obtained results supports this hypothesis – the additive strategy within large groups balances the influence of deviating individuals and the rest of members.

**Results – sharing preferences.** Next, we focused on influence of sharing preferences. Users’ events were divided into the two sets – users who saw preferences of their colleagues, and second set, where no sharing preferences were displayed. We discovered that the sharing preferences do not have (or have very small) influence on the user’s ratings. The standard deviation of these two groups differs only 0.0212. Thus, we see that the users in our experiments considered the preference of others minimally, or were very consistent in their similar opinions and thus sharing preferences were redundant.

In general, the winner, in the most of events is the *additive strategy*, followed by the multiplicative and the additive with minimal satisfaction strategy. This is quite surprising result, while the minimal satisfaction seems to be not so desirable (from the majority points of view), especially when

**Table 1: Voting strategies comparison.**

Strategy	Winning events	SD	Avg. vote
Additive	<b>184</b>	0.90	<b>4.14</b>
Multiplicative	147	<b>0.83</b>	4.08
Additive(LM)	138	0.95	4.12

a large group is interacting. Obtained results clearly show that when a large group is requesting for the recommendation, the minimal satisfaction from the group point of view decreases the quality of recommendation. This is supported by the standard deviation of obtained votes for particular strategies (Table 1). From the average score point of view, the additive strategy with least misery outperforms the multiplicative, thus the preference diversity was probably small within the group members.

**Results – users’ consistency.** Finally, we investigated users’ consistency over the various voting and events. We focused on movies rated by the user in some event and his/her rating for the same movie in other events. In order to minimize users’ effort, if the movie was rated by the user before, we presented this rating as default value (and the user was able to adjust this rating). The total of 462 such “re-ratings” were given by the users, while only in 71 occurrences the users changed the value of previous rating. This is an interesting result, which can be partially caused by the pre-filled ratings. On the other hand, the proportion of users which were consistent (85%) indicates that users adjust their ratings to the actual group context minimally (which is supported by the social psychologist as the tendency to act consistent in various situations).

### 3. CONCLUSIONS

When there is no additional information about the group available, the voting strategy seems to be the optimal solution. Here, the recommendation task is moved to the group members directly. As we shown the additive and multiplicative strategy are more preferred by small groups, while on the other side for larger groups the additive strategy is preferred. Proposed voting approach revealed that the sharing preferences have no or minimal influence to the group members in adjusting their preferences.

### 4. ACKNOWLEDGMENTS

The authors wish to thank Ján Trebul’a for helping with implementation of MovieRec. This work was partially supported by the grants No. VG1/0675/11 and APVV-0208-10.

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